

THE UNIVERSITY OF KANSAS SCIENCE BULLETIN

VOL. XXXV, PT. II]

SEPTEMBER 10, 1953

[No. 15

Frogs of the Family Centrolenidae from Brasil

BY

EDWARD H. TAYLOR * AND DORIS COCHRAN **

ABSTRACT.—This paper treats of the frogs of the genus *Cochranella*, family Centrolenidae, that are known to occur in Brasil. Twelve species are recognized, of which nine are regarded as new and described under the names, *Cochranella surda*, *C. petropolitana*, *C. lutzorum*, *C. delicatissima*, *C. bokermanni*, *C. divaricans*, *C. dubia*, *C. vanzolinii*, and *C. albotunica*. The Brazilian species, *Hylella parvula* Boulenger, *Hyla (Hylella) eurygnatha* A. Lutz, and *Hyla (Hylella) uranoscopa* L. Müller are referred to the genus *Cochranella* and the family Centrolenidae since all have the bones of the tarsus fused into a single bony shaft, similar to the tibio-fibula of all Salientia.

INTRODUCTION

For several years, as time permitted, the junior author has been preparing a report on the frogs of Brasil, but in this work she has omitted discussion of a group of small species occurring in Brasil, that in the past have been regarded as having an uncertain family relationship. Since the frogs of this group have been of especial interest to the senior author she has proposed that they be treated and published in a separate paper by the two of us.

Probably least known in the Brazilian amphibian fauna is this group of tiny frogs (28 mm. maximum snout-vent length in known Brazilian species), arboreal in habit, generally encountered clinging close to leaves of herbs and trees usually in the immediate vicinity of running water. Eggs in some, if not all, species are placed on leaves above water, the young hatching and falling into the water to continue their development.

In life most of the known species of the group are green above, the transparent flesh on the ventral surfaces permitting a fairly clear view of part of the viscera. Occasionally some yellow is

* Department of Zoology, University of Kansas, Lawrence, Kan.

** United States National Museum, Washington, D. C.

present. On fixation, in alcohol or formalin, the green disappears rapidly and such pigment as is present is visible in chromatophores, that may be equally distributed over head and dorsum, with a strip of pigmentation on the dorsal surface of the limbs (or sometimes absent on upper arm). Sometimes the chromatophores may be segregated into spots and reticulations. The color of the pigment under a lens is lavender or purplish.

The characters and habitus of these species are for the most part those of the tree frogs of the Hylidae and Rhacophoridae, and like them, there is a cartilage intercalated between the ultimate and the penultimate phalanges. These frogs differ however from typical hylids in that the terminal phalanges bear a pair of projections, commonly described as T-shaped. Because of this particular character certain authors have regarded them as belonging to the Family Leptodactylidae—believing that the greater weight should be placed on the shape of the terminal phalanges than on other more significant characters of the animal. Others have placed them with the Hylidae. The discovery by the senior author of the fusion of the astragalus and calcaneum in this group of frogs, together with other significant characters, has caused us to treat them in a family of their own.

The Family has a range extending through eastern and southern Mexico from central Veracruz and Guerrero south to and including most if not all of Brasil and a part of the various states bordering northern and western Brasil. It comprises at least three known genera and perhaps others now unknown or unrecognized. We believe that a better understanding of the group is possible by considering it of family rank, as proposed by Taylor, using for it the name Centrolenidae.*

One will, of course, expect a large fauna of species and perhaps genera in Brasil when competent exploration for these diminutive forms has been made. In the limited exploration of Costa Rica no less than eight species are now known, representing three genera.

In United States National Museum specimens of Centrolenidae, collected in the Brazilian states of Rio de Janerio, São Paulo, Minas Geraes, and the Distrito Federal, and two specimens from the zoological collections of São Paulo, we recognize some ten species. Four of these belong to a spatulate-headed section; and six to the short blunt-headed section, all seemingly referable to the genus *Cochranella*. None of these species has a humeral hook and pre-

* Taylor, Proc. Biol. Soc. Washington, vol. 64, 1951, p. 36.

sumably none has an exposed pollical spine, although one species has a pollical remnant. The vomerine teeth are absent in all of the various Brazilian species here considered.

Certain external characteristics which these species have in common are: reduced webbing on the inner fingers; the presence of an oval or somewhat circular (biscuit-shaped) palmar tubercle on the posterior part of the palm; absence of a distinct, external metatarsal tubercle; males with a vocal sac, and short or long vocal slits that are somewhat diagonally placed, not tending to parallel the line of the lower jaw, and the astragalus and calcaneum fused into a single slender shaft of bone.

Characters used to show specific differences are those of the tongue, the palatal groove, and the size of the vocal slit; size of choanae and their relative distance from each other; character of exposed tympanum or its covering, and its position with relation to the eye; size of eye, its lid, and the covering of the hidden parts of the eyeball (tunic); shape and extension of snout; head proportions; position of nostril; constriction of body behind head; size (length) of the suprascapula; anal "decoration" (*i. e.* presence of specialized granules, folds, or tubercles in the region lateral and posterior to vent); relative leg length compared to body length; webbing and character of the digits, and the character of the skin of venter (smooth, granulate or striate).

To the students of amphibians who have not had the fortune to examine these small frogs, the number of species recognized by us may seem large. We are aware that some of this material leaves much to be desired. Our experience, however, has shown that for the most part in species of this family where a series is available there is rather close conformity in characters such as body proportions, general pigmentation, anal decoration, character of webbing, etc.

It is not impossible that the eye tunic may change after long preservation and become darker. However we have no definite evidence that this occurs. In some of the species the posterior edge of the pelvic girdle seemingly extends posterior to the level of the thighs, when these are at right angles to the body; in others this is not so. We find no evidence that the method of preservation is responsible for this appearance.

In the summer of 1951, the junior author made a journey to Europe for the purpose of visiting some of the museums of Europe, and while there examined Brazilian species in London and München.

A few specimens which we and others had suspected of belonging to this group were X-rayed or dissected and the findings were as follows:

- Hylella buckleyi* Boulenger = *Cochranella buckleyi* (Boulenger)
Hylella parvula Boulenger = *Cochranella parvula* (Boulenger)
Hylella parabambae Boulenger = *Centrolene* (?) *parabambae* (Boulenger)
Hylella puncticus Boulenger = *Centrolene prosoblepon* (Boettger)
Hylella ocellata Boulenger = *Cochranella ocellata* (Boulenger)

There is no possibility that the generic name *Hylella* could be used for any small frog of this family since the type of the genus *Hylella* is *Hylella tenera* which the junior author has recently examined and which she regards as *Hyla bipunctata*. The only other species placed in the genus by Reinhardt and Lütken was *Hylella punctatissima* and this too is a hylid frog and not a member of this family.

Three species of Centrolenid frogs have already been described from Brasil, in each case under the genus *Hyla* or *Hylella* of the Family Hylidae. These are *Hylella parvula* Boulenger,* *Hyla* (*Hylella*) *uranoscopa* L. Müller,** and *Hyla* (*Hylella*) *eurygnatha* A. Lutz.***

The junior author has examined cotypes of *H. eurygnatha* in Brasil and there are several specimens, collected by Dr. A. Lutz at the type locality, available in the collections of the United States National Museum. These unquestionably are Centrolenidae and are referable to the genus *Cochranella*. The tarsal segment has a single bone (astragalo-calcaneum), and they conform in other generic characters.

The type of *uranoscopa* was likewise examined and by dissection the presence of a single bone in the tarsal joint was verified. This species, the southernmost known is from the state of Santa Catharina and is distinctly different from new forms herein described.

An X-ray photograph of the type of *parvula*, made by the authorities of the British Museum, clearly demonstrates the presence of a single bone in the tarsus of this species. This type likewise was studied by the junior author. This species seemingly cannot be identified with any of the forms here described as new.

We wish to offer our thanks to Dr. George Myers, Sr. Antenor Leitão de Carvalho, and Mr. Jay Savage for having read the manuscript and for offering helpful suggestions. Sr. Carvalho has assisted in the preparation of the map.

* Proc. Zool. Soc. London 1894, p. 646, pl. 40, fig. 3.

** Zool. Anz., Bd. 59, 1924, pp. 234-235.

*** Compt. Rend. Mém. Soc. Biol. Paris, vol. 93, no. 21, 1925, pp. 137-138.

DESCRIPTIONS OF SPECIES

SYNOPSIS OF DESCRIBED FORMS OF COCHRANELLA IN SOUTHEASTERN BRASIL.*

1. Tympanum completely concealed 2
 Tympanum partially or entirely exposed 4
2. Two outer fingers one-third to one-fourth webbed 3
 Two outer fingers with only a vestigial trace of web; a pair of relatively large postanal pads or tubercles, with some vertical wrinkles flanking pads laterally; eye tunic (covering concealed parts of eyeball) blackish; heel reaching to middle of eye; head rather narrow, not spatulate; chromatophores small, equally scattered on dorsum; 24 mm. *surda* sp. nov.
3. A pair of flattened postanal pads; eye tunic white; head short not spatulate; heel reaching to nostril; chromatophores equally distributed on dorsum; head wider than long; no pollex rudiment; 22 mm. *eurynatha*
 Probably no postanal decoration (none mentioned); eye tunic white ("skin of eyelid like body"); heel reaching to tip of snout; head as long as wide; skin with small, pinkish dots; a distinct pollex rudiment; 25 mm. *uranoscopa*
4. Venter completely or largely striate 5
 Venter granular 6
5. Venter entirely covered with longitudinal striae; no special "decoration" in region lateral to, behind, or below vent; tympanum large, distinct, directed outward; head wide, somewhat spatulate; first and second fingers equal, or first slightly longer; heel reaching beyond tip of snout; eye tunic dark; pigment equally scattered; 23.5 mm. *petropolitana* sp. nov.
 Venter longitudinally striate save on posterior part where striae form irregular elongate granules; a pair of vertical ridges curving across thighs to ventral surface behind vent; tympanum covered with skin, but outline clearly visible, directed nearly vertically upward; head broad, spatulate, the front sloping obliquely to lip in front of nostril; heel to a point 2 mm. beyond tip of snout; pigment chromatophores large, unevenly scattered on dorsum; eye with white tunic, *lutzorum* sp. nov.
6. Tympanum directed laterad 7
 Tympanum directed wholly (or largely) upward 8
7. Tunic of eye black; tympanum covered with skin but outline clearly visible; heel to a point beyond tip of snout; no decoration in region of vent; skull not transparent; outer fingers only one-fourth webbed; 20.8 mm. *delicatissima* sp. nov.
 Eye with a brown or black tunic; tympanum covered with skin, its outline visible, directed outward; heel to a point between eye and nostril; a pair of swellings behind vent, widely separated; webbing between outer fingers vestigial; pigment rather

* Since so many significant characters of *Cochranella parvula* are not known to us, we are omitting this species from the synopsis. Its relationship may be with *delicatissima*.

- equally distributed* in small chromatophores; skull transparent, showing outline of brain (not impossibly a result of preservation); 20.4 mm. *bokermanni* sp. nov.
8. Eye with a dark tunic; no anal decoration; tympanum partly covered, directed nearly vertically upward (and slightly backward); heel to front edge of eye; head short, nonspatulate; venter smooth (?); dorsum smooth no granules evident on under side of thigh (?); *color nearly uniform lavender*, the individual chromatophores not visible to eye; 20 mm.,
divaricans sp. nov.
- Eye with a white or cream tunic; *chromatophores large not equally distributed but tending to segregate*; venter and thigh distinctly granulate 9
9. *Interorbital area elevated and sloping rather abruptly to base of snout*; nostril nearer eye than to mid-point on lip; anal decoration lacking; heel reaching to tip of snout or slightly beyond; chromatophores segregated into an indefinite pattern of spots or groups; 23.5 mm. *dubia* sp. nov.
- Interorbital area not elevated 10
10. *Smaller, a yellow-cream spot almost covering tympanum*; upper eyelid heavily pigmented with purple; lip bordered by a row of cream tubercles; upper arm very slender; *forearm greatly thickened*, permanently flexed (?); heel to tip of snout; very short anal flap; a pair of enlarged postanal granules; suprascapulae not especially broadened; 20 mm. *vanzolinii* sp. nov.
- Larger, no yellow or cream spot on tympanum; spatulate-headed; tympanum small at least partly distinct, directed outward and upward; heel reaching to a point much beyond snout; no row of tubercles on lip; forearm not especially thickened; suprascapulae very broad, prominent; 27 mm. *albotunica* sp. nov.

Cochranella surda sp. nov.

(Fig. 1)

Type: U. S. National Museum No. 96916, Passo Quatro, Minas Geraes, Brasil; Zikan, coll., November 1920.

Paratype: U.S.N.M. No. 96917. Same locality and collector.

Diagnosis: A short-headed species, the eyeball blackish, the concealed parts surrounded by a dark tunic; pigment where present equally distributed, not reticulated; tympanum hidden under skin, the tympanic region nearly vertical; distance between orbits equals width of an eyelid; nostrils nearer to eyes than to median point in upper lip; dorsal skin finely corrugated, belly strongly granular; outer fingers with a web vestige (one-fifth webbed or less); terminal discs oval, the sides and tips curving, not truncate; first and second finger of approximately even length; a pair of prominent anal pads; a strong inner tarsal fold; a distinct heel ridge; heel to anterior edge of eye.

Description of type: Head width (8 mm.) greater than head length (7.1 mm.); region about nostrils swollen but no depression evident on snout or on top of head; canthal region short, the canthus rostralis absent, the loreal region not or but slightly concave, sloping obliquely to edge of lip; tip of snout, seen in profile, sloping some-



FIG. 1. *Cochranella surda* sp. nov. Type, U.S.N.M. No. 96916. Passo Quatro, Minas Geraes, Brasil.

what, the nostrils not terminal; tympanum hidden under skin with no trace of its outline; a fold above tympanic region faintly indicated; eye moderate, prominent, directed somewhat forward, its length (2.6 mm.) greater than length of snout (2.3 mm.); nostril nearer the eye than median point on upper lip, which is not notched; width of an eyelid (2 mm.) equals interorbital width; region back of eyes not or but very slightly constricted.

Choanae longer than wide; width of one (.4 mm.) in distance between them (1.8 mm.) $4\frac{1}{2}$ times; a strongly defined transverse

groove for openings of palatal glands close to anterior edge of choanae; no trace of vomerine teeth; tongue broader than long, not or but slightly free behind, slightly emarginate posteriorly; openings of vocal sacs short, diagonal.

Wrist extending beyond tip of snout; a very slight axillary web; first finger distinctly smaller and shorter than second; well-developed pads or discs on fingers, the tips distinctly wider than digits, the tips rounding rather than truncate, the sides rounded rather than angular; the discs transversely oval rather than subtriangular; no trace of web between first three fingers; a trace between fourth and third with a slight ridge following outer edge of third digit; a large broad metacarpal tubercle, and a well-defined, oval, palmar tubercle.

Heel to middle of eye; toes with terminal discs smaller than fingers, the first two fingers $\frac{1}{3}$ webbed; the second and third, $\frac{1}{2}$; the third and fourth, $\frac{2}{3}$; the fourth and fifth, $\frac{1}{2}$ webbed; an ill-defined inner tarsal fold; a small inner metatarsal tubercle; no distinct outer tubercle.

Skin of dorsum, seen under a lens, minutely corrugated; chin and breast smooth; venter strongly granulate, under surface of thigh granular; anal opening high; a short anal flap with a broad free edge; a pair of large postanal pads or tubercles, with some vertical wrinkling flanking them laterally.

Color: Probably green in life. In preservative transparent flesh with dorsal surface of body, head, and upper surfaces of limbs covered with nearly equally distributed, fine, purplish-lavender chromatophores; edge of lip lacking pigment; ventral and concealed surfaces transparent, whitish-flesh; eyelids surrounded by a dark purplish tunic; iris purplish.

Measurements in mm. of type and paratype

Number	96916	96917
Snout to vent	21.5	24
Width of head	8	8.5
Length of head	7.1	7.5
Length of eye	2.6	2.7
Length of snout	2.3	2.3
Arm	17	16
Hand	8.8	7.8
Leg	33.2	37.4
Tibia	11	10.4
Foot and tarsus	14	18

Cochranella eurygnatha (A. Lutz)

(Fig. 2)

Hyla (Hylella) eurygnatha A. Lutz, Compt. Rend. Mém. Soc. Biol., Paris, vol. 93, no. 21, June 19, 1925, pp. 137-138 (type locality, Serra da Bocaina, Brasil); Trabalho Inst. Oswaldo Cruz, Mar. 10, 1926, pp. 5, 12.
Centrolenella eurygnatha B. Lutz, Copeia, no. 4, 1947, p. 243.

Diagnosis: Snout short, not spatulate, the nostrils nearly terminal; eyeball surrounded by a whitish tunic; tympanum concealed under skin; belly strongly granular; outer fingers not more than one-fourth webbed, the discs much widened, curved rather than truncate; all digits with terminal grooves on hand and foot; heel to nostril; anal flap rather broad, notched mesially, flanked behind by indefinite, flattened, anal pads, with some few enlarged granules on ventral surface; no outer tarsal tubercle; a deep groove across palate for openings of palatal glands.



FIG. 2. *Cochranella eurygnatha* (A. Lutz). No. 7926 Coll. Departamento de Zoologia, Secretaria de Agricultura São Paulo Brasil; Itatiaia, Rio de Janeiro, Brasil. Actual length, snout to vent, approximately 22 mm.

Description of species: (From U.S.N.M. No. 96656 ♂ from Bonito, Serra da Bocaina, State of Rio de Janeiro, near the São Paulo boundary, late February 1928, Dr. A. Lutz, B. Lutz, and J. Venancio, colls.). Head width (8 mm.) greater than head length (7.1 mm.); snout very short, truncate, the nostrils nearly terminal; canthus rostralis somewhat swollen but only a meager depression between canthi; tympanic area lateral, the tympanum concealed under skin; the supratympanic fold not or only indistinctly indicated; length of eye opening (2.4 mm.) about as long as the snout (2.5 mm.); the eye directed somewhat forward, and prominently elevated; distance between eye and nostril (1.8 mm.) nearly equal to distance between nostril and median notch on lip (1.82 mm.); interorbital interval (2.1 mm.) about equal to width of eyelid (2.2 mm.); distance between nostrils about equal to their distance from eye.

Choanae large, the distance between them 2.7 mm.; diameter of one choana in distance between, 3.5 times; a distinct deep transverse palatal groove crosses palate a short distance in front of choanae, almost reaching choanae on outer ends; the edges of the groove may be thickened and the skin in front seems loose; tongue broader than long, slightly emarginate behind, and free behind for approximately a fourth of its length; vocal sac indicated externally by longitudinal folding of the skin on chin and neck; vocal slits run somewhat diagonally from near jaw forward and across to tongue.

Arm with wrist reaching considerably beyond tip of snout; first finger shorter than second, but digits of nearly same width; fingers bearing broad terminal pads with terminal grooves, the discs distinctly wider than the digits, and delimited; the tips moderately rounded rather than sharply truncate; about one-fourth webbed between outer fingers; web absent between other fingers; a large, rather broad, inner metacarpal tubercle; a prominent rounded median palmar tubercle; subarticular tubercles distinct; supernumerary tubercles on palm and sole; heel reaches to nostril; when legs are folded at right angles to body, heels overlap 2.5 mm.; when laid along body, heel and elbow overlap; the presence or absence of an inner tarsal fold cannot be determined; inner metatarsal tubercle present, outer absent.

Skin everywhere smooth on dorsal surfaces; chin with surface of vocal sac longitudinally folded; breast smooth; venter covered with rather large granules; median part of ventral surface of thigh with a few granules, some distinctly larger than others; vent high, covered with a short, rather wide flap, notched mesially, flanked be-

hind by two, irregular, large, flattened but relatively distinct anal pads.

Color: Flesh color, with lavender-purple pigment in small chromatophores, their distribution on dorsal surfaces of body nearly equal, not segregated into spots or a reticulum; chromatophores sparse on sides of head; venter and concealed parts of limbs flesh-color, probably transparent in life; tunic surrounding concealed parts of eyeball, cream-white, the iris white with purple streaking or clouding; anal flap pigmented. The species is probably green on exposed surfaces in life.

Measurements in mm.: Snout to vent, 22; width of head, 8; length of head, 7.1; length of eye, 2.4; interorbital width, 2.1; arm, 16; hand, 8; leg, 35.5; tibia, 11; foot and tarsus, 17.

Remarks: All the specimens of the topotypic series (U.S.N.M. nos. 96652-96661) are of the same species, all males except for a single small female (No. 96662). Tadpoles associated under the number 96663 seem to belong to more than a single species some of which may belong to this species. (See discussion of these elsewhere.)

The original description of this species is as follows: "*Hyla* (*Hylella*) *eurygnatha*; L. 17 mm.—Le dessus est vert, passant au jaunâtre au museau, aux doigts, aux orteils et sur une ligne marginale. Tête courte, élargie derrière les yeux, ce qui est dû à la largeur de la mandible. Iris or mat; lobule supérieur et inférieur au bord de la pupille. Pointillé noirâtre plus accentué après la mort. Membrane court entre les doigts, plus longue entre les orteils. Un seul exemplaire provenant de la Serra da Bocaina."

The drawing is of a specimen recently forwarded by Mr. Werner Bokermann (No. 7926) from Itatiaia, Brasil. The specimens recently preserved show more pigment, especially on eyelids, and there are some indistinct lighter spots, which may have been more evident in life. The fingers may be a trifle less than one-fourth webbed.

Cochranella uranoscopa L. Müller

Hyla (*Hylella*) *uranoscopa* L. Müller, Zool. Anz., Bd. 59, 1924, pp. 234-235 (type locality, "Humboldt [Flussgebiet des Rio Novo], Santa Catharina", S. E. Brasil; Bavarian States Herpetological Collection No. 81/1921, W. Ehrhardt, coll. Nov. 1919).

Diagnosis: Tympanum hidden; a large angular pollex-rudiment.

Description of the type: The frog appears very strongly depressed, at the same time proportionally slender; width of body is contained two and one-half times in the snout-vent length; head

rather large (contained two and three-fourths times in the snout-vent length), as long as broad and very flat; head broadest in region of eye and narrows itself from eye to region back of tympanum, so that it appears to be set off from body by a slight necklike constriction. The limbs are rather long and slender; choanae moderately large; vomerine teeth lacking; the tongue oval, completely marginate, only free on edge; snout longer than eye, broadly rounded anteriorly; canthus rostralis not present and loreal region slopes gently out and down; eyes not lateral but are obliquely directed upward; nostrils directed upward; the interorbital space equals the length (diameter) of the eye; distance of nostrils from tip of snout equals two thirds its distance from eye; tympanum hidden under the skin; fingers slender, slightly flattened, with moderately large anteriorly truncate finger discs; first finger somewhat shorter than the second; on its basal part a moderately large angularly protruding flat spreading pollex-rudiment is in evidence; between third and fourth fingers one-third webbed; between the second and third somewhat less than one-third webbed; between the first and second fingers the web is vestigial.

Toes moderately long, likewise flattened, half webbed; subarticular tubercles on fingers and toes weakly developed; a distinct, elongate, strongly compressed metatarsal tubercle present; hind leg pressed against body, the tibiotarsal articulation reaches tip of snout; tibia somewhat longer than femur, measures one and two thirds the head length.

Skin of the dorsum finely granular; that of the ventral side strongly granular. A fold goes from back end of eye, over tympanum to insertion of upper arm.

Color: Color of the head and dorsum pale, characteristically transparent, bluish green which laterally becomes more yellowish; the limbs yellowish; entire upper side, with the exception of upper arm and parts of hind leg that are concealed when crouched, is covered with thickly distributed brownish-gray spots consisting of thickly distributed punctations; underside bright olive-yellow, transparent on the belly.

Measurements in mm: Head-body length, 25; head length, 9; head width, 9; length of hind leg, 46; length of tibia, 14; tibiotarsal articulation to tip of longest toe, 19.

(Data from type description).

Cochranella petropolitana sp. nov.

Type: U. S. National Museum No. 101135, Petropolis, Rio de Janeiro, Brazil; A. Lutz, Bertha Luth and Doris Cochran, colls., May, 1935.

Diagnosis: Head rather broad, somewhat spatulate, body depressed; tympanum large, very distinct, lateral, relatively close to jaw, directed outward; no specialization of fold, grooves or tubercles in anal region; the vent high, the anal flap short and wide; pigment where present scattered nearly equally on dorsal surfaces, with no tendency to segregate and form spots or reticulations; none, or only an ill-defined fold above tympanum; eye tunic dark.

Description of type: (The specimen is indifferently preserved and in the region of the tip of the snout and on hand and foot the characters are somewhat obscured.) Small frog, snout-to-vent length 23.5 mm.; head rather spatulate, widest part being opposite eye, narrowing a little near jaw angle; head depressed, the canthus not, or barely indicated, rounded, sloping obliquely to lip, with a shallow depression behind nostril in loreal region; area about nostrils slightly swollen, however no depression is indicated between swellings; tympanum distinct, not covered with skin or pigmented; its vertical diameter (1.1 mm.) a little greater than its length (1 mm.), separated from eye by a distance equaling the greatest diameter; length of eye (estimated 2.4 mm.) less than length of snout (estimated 3.5 mm.); tongue somewhat wider than long; vocal slits present in mouth, but no external evidence of vocal sac; no vomerine teeth; choanae large, length equal to half distance between them.

Arm with wrist extending considerably beyond tip of snout; first finger as long as second or (on right hand) a little longer than second; tips of fingers widened into truncate discs, distinctly wider than digit; inner fingers without web; two outer fingers about one-third webbed; inner metacarpal tubercle moderately distinct; median palmar tubercle subcircular, distinct.

Leg slender, tibiotarsal articulation extending two millimeters beyond tip of snout; when legs are flexed at right angles to body, heels overlap; when flexed on side of body, knee and elbow overlap; toes three-fourths to four-fifths webbed; the terminal discs truncate, smaller than those on fingers; inner metatarsal tubercle distinct, outer absent or obsolete.

Skin smooth on the dorsal and concealed surfaces; chin and breast smooth; venter longitudinally striate; no granules evident on ventral face of thighs; no distinct fold above tympanum.

Color: Probably green or olive in life, the venter transparent; in preservative flesh white with a thick scattering of lavender or purplish pigment, the chromatophores of nearly equal size; on head, pigment less dense on lips and loreal region; there is a narrow strip of chromatophores on surface of upper arm and upper surface of thigh, wider areas of chromatophores on forearm and tibia, the pigment extending onto outer finger and toe; a small area below vent pigmented; eyeball above, showing dark pigment through upper eyelid, the iris likewise being dark.

Measurements in mm. of type: Snout to vent, 23.5; greatest width of head, 8.6; width at jaw angle, 7.3; length of head, 7.6; arm, 16; hand, 8; leg, 41; tibia, 14; foot and tarsus 17.5.

Remarks: The specimen is not well preserved and the character of the subarticular tubercles, the eyelid and the length and shape of the snout in front of the nostrils cannot be determined satisfactorily. It is interesting that the specimen was taken at the same place as the type of *Cochranella lutzorum*. Both are rather similar in general appearance, but the following specific differences are in evidence:

- | | |
|--|---|
| 1. Tympanum distinct, low, lateral, directed outward. | 1. Tympanum partially concealed under skin, and directed upward. |
| 2. No anal folds or tubercles. | 2. A pair of vertical folds extend across the posterior face of thigh behind vent to ventral surface. |
| 3. Pigment rather equally distributed on dorsum; pigment on upper arm. | 3. Pigment forming a reticulum over dorsum, absent from upper arm. |

Cochranella lutzorum sp. nov.

Type: U. S. National Museum No. 101134, Petropolis, Rio de Janeiro; colls., A. Lutz, Bertha Lutz, and Doris Cochran; May, 1935.

Diagnosis: A moderately large species of the genus with a broad spatulate head, the front of the snout sloping obliquely to lip in front of nostrils; tympanum covered with skin; the outline partly concealed; a pair of vertical folds behind vent; no pigment on upper arm.

Description of type: Area about nostrils swollen with a depression between continued on down to edge of lip and bordered by two distinct elongate elevations; nostrils separated from eye by a distance of 3 mm., from median edge of lip by 2.6 mm.; canthus rostralis absent; a longitudinal depression midway of the loreal region, the lower part sloping very obliquely to lip; tympanum covered with thin skin but its entire outline distinct, directed up-

ward, separated from the eye by a distance equal to $1\frac{1}{2}$ times diameter of tympanum; length of eye, 2.65 mm., a little more than $2\frac{1}{2}$ times greatest diameter of tympanum, but much less than snout length (5 mm.); upper lip indistinctly notched; no trace of vomerine teeth; choanae moderately large, longer than wide, the distance between them (2.2 mm.) contains width of one (.5 mm.) a little more than four times; tongue large, much wider than long, not or but only a narrow fringe free behind; (vocal sacs present in males?).

Arms slender, the wrist reaching distinctly beyond mouth; the digits moderately slender, elongate, with widened truncate terminal discs; web lacking between first three fingers; about one-fourth webbed between the two outer fingers; a flattened protruding inner metacarpal tubercle; a prominent median rounded palmar tubercle; subarticular tubercles moderately distinct. Leg long, the heel extending 2 mm. beyond tip of snout; discs on toes smaller than those on fingers, truncate; the first toe with web reaching half its length; on outer side of second three-fourths webbed, third and fifth toes two-thirds webbed, the fourth toe with two and a half joints free; subarticular tubercles small but distinct; inner metatarsal tubercle small, slightly projecting; outer not distinctly indicated; the character of the tarsal fold cannot be determined but seemingly present; a small fold or ridge on heel.

Skin smooth on dorsal surfaces; chin and breast smooth; anterior part of venter finely striate longitudinally, the posterior part broken up into somewhat elongate granules; on under side of thigh large round granules indicated on posteroventral face; vent high, covered with a short pigmented flap; a pair of high vertical ridges curve across the thighs to ventral surface. Scapulae large, broad, elevated, their inner edges forming two irregular elevations which seemingly are discernible in life since the edge marks an elongate spot following the elevated portion.

Color: (In preservative.) Flesh white with lavender pigmentation unequally distributed; tip of snout and lips with sparse unequal pigmentation; top of head and dorsum with some segregation of chromatophores leaving small irregular pigmented areas; eye with whitish tunic; upper arm lacking pigment or at most a few chromatophores; forearm pigmented, the pigment continuing sparsely on outer finger to near tip; a narrow line of chromatophores on upper face of thigh, wider on tibia continuing sparsely on tarsus and two outer toes. Entire ventral surface flesh white (probably transparent in life).

Measurements in mm.: Snout to vent, 28; width of head, greatest, 10.3; width at jaw angle, 9.3; length of head, 8; diameter of tympanum, 1.05; length of eye, 2.6; length of snout, 5; arm, 18; hand, 8; leg, 46; tibia, 16; foot and tarsus, 21.

Remarks: The species is dedicated to Dr. Bertha Lutz and her illustrious father, Dr. A. Lutz.

Cochranella delicatissima sp. nov.

Type: U. S. National Museum No. 96481, Angra dos Reis, Rio de Janeiro; A. Lutz, coll.

Diagnosis: Snout short not spatulate the nostrils nearly terminal; flesh of body very white with a very fine scattering of lavender pigment; tympanum pigmented, visible, directed laterad; interorbital space wider than an eyelid; anal decoration probably absent, the pelvis extending a little behind level of thighs²; heel to beyond tip of snout; outer fingers about one-fourth webbed.

Description of type: (where characters are somewhat obscured the word "probably" is used.) Width of head, (7.8 mm.) greater than length (6.5 mm.); the canthus barely indicated; the tip of snout in lateral profile curving slightly to lip, the nostrils not quite terminal; loreal region slightly concave near eye, sloping obliquely to lip; tympanum distinct, pigmented, directed laterally outward and perhaps a trifle upward; its distance from eye double its greatest diameter; eye large, its length (3 mm.) distinctly greater than snout length (2.1 mm.); canthus rostralis barely indicated; the medial loreal region slightly concave near eye, sloping obliquely to lip; area about nostrils slightly swollen with a slight depression between, more or less evident down to lip; nostril as near to eye as to median point on upper lip; width of upper eyelid less than interorbital interval.

Choanae large, the greatest diameter of one, contained in distance between them about two times; groove for palatal glands absent or obsolete; openings of vocal slits elongate, diagonally placed; tongue wider than long, narrowed posteriorly, not or but slightly emarginate, free only on posterior edge; no trace of vomerine teeth.

Arm long, more than half of forearm extends beyond tip of snout; a small inner metacarpal tubercle; a rounded palmar tubercle; outer fingers one-fifth webbed; other fingers without or with only a trace of web; discs present (the tissues of the fingers have partially sloughed off so details of the discs and webs are not wholly clear); first finger shorter than second; heel to slightly beyond tip of snout;

probably no inner tarsal fold; small metatarsal tubercle, outer tubercle absent; toes probably three-fifths webbed.

Skin smooth on dorsal surfaces; venter with distinct fine granulations; probably no anal decoration but the sacrum extends slightly behind level of thighs on median line.

Color: Everywhere flesh white with a thin regular scattering of lavender in tiny chromatophores (in many places the skin has been rubbed and the color is seemingly absent); tunic about concealed parts of eye at least for the most part whitish. Iris light with some light lavender; pigment confined to dorsal surfaces but extending narrowly on limbs to outer fingers and toes.

Measurements in mm.: Snout to vent, 20.8; width of head, 7.8; length of head, 6.5; length of eye, 3; length of snout, 2.1; arm, 15.5; hand, 7.2; leg, 35.5; tibia, 11.4; foot and tarsus, 15.7.

Cochranella bokermanni sp. nov.

Type: Departamento de Zoologia, Secretaria de Agricultura, São Paulo, Brasil, No. 328, Itatiaia, Rio de Janeiro, May, 1906, Leuderwaldt, coll.

Diagnosis: A diminutive species, the head not spatulate, the dorsal skin glassy smooth; the chin smooth, the venter and under face of thigh granular, the granules large and irregular on thigh and posterior part of venter; a pair of slight swellings behind vent, widely separated; tympanum covered, its outline faintly visible; neck not constricted; heel reaching to between eye and nostril; web vestige between fingers two and three, a larger vestige between three and four. A slight fringe on outer edge of third; inner toes about one-half, or less webbed; outer toes three-fifths to three-fourths webbed; first finger much shorter than second.

Description of type: Head short the width (7 mm.) greater than length (6.1 mm.); canthus absent, the interorbital area rather flat and transparent showing the complete outline of the brain; snout somewhat oval rather than rounded, seen from above; nostrils nearly terminal, minute, equidistant from eye and the median point on upper lip; nostril not noticeably swollen and no depression occurs between; eyes large, directed somewhat forward, the length (2.45 mm.) greater than length of snout (2 mm.); tympanum covered with skin its outline partly visible, the loreal region sloping obliquely to lip, not or scarcely concave; snout extending about .75 mm. beyond mouth; width of an eyelid (1.8 mm.) less than interorbital interval (2.1 mm.); choanae moderate, the diameter of one (.7 mm.) in distance between them approximately 2.2 times. Eye with a

brown tunic (the eye possibly red in life); palatal glands open into a nearly straight groove, nearer the choanae than front of palate; tongue rather thick, wider anteriorly than posteriorly, free for less than one fifth of its length, unemarginate behind; opening of Eustachian tubes equal to choana; (specimen a female lacking vocal slits).

Wrist reaching beyond snout tip; first finger shorter than second, with no trace of a web between them; between second and third fingers a distinct vestige and a larger vestige between two outer fingers (less than one-fifth webbed); tips of digits widened, sharply truncate, the subterminal "discs" subtriangular; subarticular tubercles single, moderately distinct; a small inner metacarpal tubercle, the palmar tubercle irregular, large; an indistinct fold on outer finger continued along the outer, under edge of arm.

Legs slender the heel reaching to nostril; inner toes less than half webbed, the outer nearly three-fourths webbed, subarticular tubercles indicated but there are no distinct supernumerary tubercles on sole or palm; a small, inner metatarsal tubercle and an indistinct outer tubercle; a distinct inner tarsal fold. Outer fold, if present, very indistinct.

Skin shining smooth above on head and dorsum; chin and breast smooth; venter with smaller granules anteriorly, larger more irregular ones posteriorly; under side of thigh with still larger irregular granules; presumably a pair of small pustular swellings behind vent. Anal flap short, wide, the vent opening at upper thigh level.

Color: (Faded in preservative). Whitish flesh above and whiter below; a small pigmented area visible on right side, the brownish lavender pigment scattered; eyelid appearing dark, taking color from the tunic of eyeball.

Measurements in mm.: Snout to vent, 20.4; width of head, 7; length of head, 6; length of eye, 2.45; length of snout, 2; arm, 18.4; hand, 7; leg, 32; tibia, 11; foot and tarsus, 15.

Remarks: The exposed brain is clearly visible, the posterior part being much widened, a little more than double that of the cerebral hemispheres and equal to the brain length. (The width is 3.5 mm. the greatest length 3.5 mm.)

The relationship of this species is probably closest to *Cochranella surda*, but seemingly differs in the greater width of an eyelid in relation to interorbital interval, in having the skin glassy smooth instead of being finely corrugated, and in having the first and second finger of nearly equal length, as well as other less obvious differences.

The species is dedicated to Mr. Werner Bokermann of the Museum of the Departamento do Zoologia who has given us the privilege of studying this form and *Cochranella vanzolinii*.

Cochranella divaricans sp. nov.

Type: U. S. National Museum No. 96562 ♂, Serra da Bocaina; A. Lutz coll.; Jan. 2-19, 1930.

Diagnosis: A small frog with a short head; lavender pigment in large spreading chromatophores that are contiguous or nearly so; eyeball with a dark tunic; the interorbital interval probably approximately equal to width of an eyelid; heel to front edge of eye; tympanum covered (outline partly visible); moderate, necklike constriction behind head; outer fingers one-fourth webbed; toes three-fifths to three-fourths webbed, the digital disks sharply truncate and angular, the pads subtriangular in shape.

Description of type: A small species, the type being 20 mm. in snout-vent length; width of head (7.2 mm.) greater than length of head (6.3 mm.); tympanum covered with pigmented skin but on one side its outline is dimly evident, showing it directed largely upward and slightly backward; the distance of tympanum from eye at least once and a half the diameter of the tympanum; eye large, directed partly forward, its length (2.5 mm.) greater than snout length (2 mm.); nostrils slightly injured (presumably by insects), probably swollen somewhat, although there is no evidence of a depression between them or on snout, and probably equidistant between median point on lip and eye; canthus rostralis barely indicated, rounded; loreal region not concave, but sloping rather abruptly to lip; eyelid probably nearly equal to interorbital distance; a necklike constriction behind head and partly including back part of head.

Choanae large, irregular, their greatest diameter contained in distance between them about two and one-third times; no trace of vomerine teeth; a pair of vocal slits somewhat diagonally placed; tongue (distorted) wider than long, free for at least one fourth of its length (membranes of the palatal region have sloughed so that the character of the palatal groove is not discernible, and the bony rim of the choanae is exposed).

Arm brought forward the wrist reaching a little beyond tip of snout; first finger shorter than second; digits with sharply truncate, angulate discs, considerably wider than the digits; the pads on the disc subtriangular in shape; web vestigial between first and second fingers; approximately one-fifth webbed between second and third,

and one-fourth webbed between third and fourth; a well-developed inner metacarpal tubercle; without trace of a pollical spine; a rounded palmar tubercle.

Heel reaching to a point immediately in front of eye; leg slender when folded at right angles to body, the heels overlapping 2 mm.; webbing between the toes reaches three fifths to three fourths of the length of digits except on the fourth; discs at tip much wider than the digits, and only a little smaller than those on fingers; a small, flat, inner metatarsal tubercle (two indistinct tubercles on posterior median part of sole); no outer metatarsal tubercle.

Skin above smooth; venter seemingly smooth, definitely not striate but some granules may have been present in life; no distinct anal decoration, and no granules evident on the under side of the thigh. Subarticular tubercles not strongly marked.

Color: Above on body uniformly lavender, the pigment spread, rather than segregated in small dots, although on dorsal surfaces of limbs the pigment is in rather discrete dots; very little pigment on upper arm; venter and concealed surfaces of the limbs and body transparent flesh; under a lens one sees numerous minute lighter (probably white in life) areas scattered on dorsal surface of body and head; on limbs pigment extends to tips of outer digits.

Measurements in mm.: Snout to vent, 20; length of head, 6.3; width of head, 7.2; length of snout, 2; length of eye, 2.5; arm, 13; hand, 6.3; leg, 31; tibia, 10.5; foot and tarsus, 13.

Cochranella dubia sp. nov.

Type: U. S. National Museum No. 96722, Serra da Bocaina, boundary of Rio de Janeiro and São Paulo, By A. Lutz; Dec., 1930-Feb., 1931.

Diagnosis: A spatulate-headed form with the interorbital area elevated, and sloping rather abruptly to base of snout; nostril a little closer to eye than median point on upper lip; tympanum distinct, directed upward; concealed part of eyeball with a white tunic; eye large, its length equals snout length; eyelid distinctly less than interorbital distance; probably no especial anal decoration, but the pelvic bones push back forming a decided posterior median protrusion behind level of thighs; heel reaches tip of snout or minutely beyond; discs on hand and feet nearly same size, relatively smaller than those of other spatulate-headed forms, their shape subtriangular rather than transversely oval; venter probably granular (?); purplish pigment in large chromatophores segregated into groups forming indefinite spots.

Description of type: Head somewhat spatulate, moderately wide, somewhat narrowed at jaw angles, the width (7.8 mm.) greater than length (7.3 mm.); canthus rostralis indistinct or absent, the snout sloping obliquely to lip, the loreal region not or but slightly concave; tympanum distinct, round, directed upward, its distance from eye greater than its diameter; eye very large, somewhat directed forward, its length (3 mm.) equal to length of snout (3 mm.); areas about nostrils swollen, with a slight depression between them; snout sloping forward obliquely in front of nostrils; width of an eyelid distinctly less than interorbital width, the area between the orbits and occiput elevated, sloping abruptly down to snout at anterior level of eyes; choanae moderate, their longitudinal diameter in distance between them, approximately two times; upper rim of choanae followed outward terminates in a lobulate projection of bone; a strongly defined transverse groove in palate for openings of palatal glands, much closer to choanae than to front of palate; tongue thick, subcircular, posteriorly emarginate, free for one fourth of its length and attached (seemingly) by a series of elongate lamellate, muscular fibers; large diagonal vocal slits; no trace of vomerine teeth.

Arm long, nearly half of forearm extends beyond tip of snout; digits with relatively narrow terminal discs the shape of pad subtriangular rather than transversely oval; first and second fingers equal, or second a trifle longer; digits slender, with a vestige of web between first two fingers, about one-fifth (or less) webbed between second and third; between outer fingers one-fourth webbed; inner metacarpal tubercle relatively small; palmar tubercle large, distinct, somewhat rounded; leg with heel reaching to or minutely beyond tip of snout; discs on toes small most of them not or scarcely wider than digit; probably an inner tarsal fold; inner metatarsal tubercle small, outer absent; foot about three-fourths webbed throughout; when limbs are folded at right angles the heels touch but do not overlap; knee and elbow overlap.

Skin of body is smooth; probably a short distinct skinfold above tympanum; suprascapulae not forming ridges; venter indistinctly granular but granules are not regular; indication of some granules under the femora; pelvis somewhat protuberant behind level of thighs.

Color: Deep purplish, on body and head, and dorsal surfaces of limbs, on a ground of flesh, the large chromatophores segregated into irregular groups sometimes suggesting reticulation; (probably

no pigment on upper arm); below flesh; (a few brownish areas on venter and under side of limbs are probably due to discoloration).

Measurements in mm.: Snout to vent, 23.5; width of head, 7.8; length of head, 7.3; length of eye, 3; length of snout, 3; arm, 17; hand, 8; leg, 40; tibia, 13; foot and tarsus, 17.

Remarks: This species was taken in the Serra da Bocaina by Dr. A. Lutz together with the species described as *Cochranella albottunica* sp. nov.

Cochranella vanzolinii sp. nov.

(Fig. 3)

Type: Collection of the Departamento de Zoologia, Secretaria da Agricultura (Ipiranga, São Paulo, Brasil) No. 2952, from Boracea, São Paulo. Collected December 12-19, 1947 by P. Vanzolini and W. Bokermann.

Diagnosis: A diminutive species; pigment not equally distributed; head slightly spatulate; venter granular; tympanum distinct, directed only slightly upwards and covered by a cream-yellow spot size of tympanum; choanae small, diameter of one in distance between choanae, 4.5 times; upper arm very slender; forearm greatly thickened; fingers flattened, truncate at tips, the tips only slightly wider than digits, distinctly wider than toes.

Description of species: Snout-to-vent measurement, ♂, 20 mm.; width of head (7.7 mm.) less than its length (7 mm.); canthus rostralis present but rounded somewhat, the loreal region shallowly concave, sloping to upper edge of upper jaw, the remainder nearly vertical to tip; area about nostrils a little swollen with a slight depression between them, the nostrils not terminal but the snout sloping obliquely to lip; tympanum small, its diameter (.8 mm.) contained in length of eye (2.7 mm.) approximately 3.4 times; pupil of eye horizontal the upper edge with a tiny rounded median projection above giving the pupil a dumbbell shape when contracted; length of eye greater than length of snout (2.4 mm.); nostril almost equidistant between eye and median point on upper lip; eye directed somewhat forward; covering of the concealed parts of the eyeball white but eyelid itself heavily pigmented with dark purple; extent of upper eyelid not clearly defined but definitely less than the interorbital distance; choanae small, the greatest (diagonal) diameter of one choana in distance between them, 4.5 times; openings of the palatal glands form a sinuous groove close to anterior level of choanae; tongue broadest anteriorly, narrower posteriorly, unemarginate, free for less than a fourth of its length; vocal slits large; vocal sac evident on chin, displaying ample folds.

Upper arm very slender, about one third thickness of forearm; (the arm appears to be permanently flexed at elbow); fingers flattened, nearly truncate the subterminal discs somewhat triangular in shape; second finger distinctly longer than first; a web vestige between first and second, and second and third fingers; approximately two-fifths webbed between the third and fourth; subarticular tuber-



FIG. 3. *Cochranella vanzolinii* sp. nov. No. 2952. Type. Departamento de Zoologia, Secretaria da Agricultura, São Paulo, Brasil. Boraceia, São Paulo. Actual length, snout to vent, 20 mm.

cles distinct and single; supernumerary tubercles present on digits and palm; a well-defined inner metacarpal tubercle; a well-defined single palmar tubercle; fringe on outer finger continued along arm as a distinct fold and bearing a number of elongate white tubercles; heel reaching to tip of snout; a distinct outer tarsal fold continuous with the fringe on outer toe and bearing occasional elongate white tubercles, terminating in a slight heel-fold; subarticular tubercles distinct; a small inner metatarsal tubercle; and a small but very

indistinct outer tubercle; inner metatarsal fold indistinct. When legs are folded the heels overlap 2.5 mm.; no axillary web; toes nearly four-fifths webbed.

Skin generally smooth on dorsum; side of head and dorsolateral region with a few scattered low tubercles, whitish or cream in color; other similar small tubercles scattered on dorsal or exposed surfaces of limbs and in region below and about vent; the chin, breast, and venter closely granular, this extending to the pigmented area on sides; some granulation on under surface of thighs; skin on each side of vent seemingly swollen; a pair of strong, somewhat conical tubercles or granules on ventral surface of thigh below vent; anal flap short and broad, the vent opening near upper thigh level.

Color: In preservative, whitish with a pigmentation of lavender or purple in numerous chromatophores, unequally distributed leaving lighter reticulation and spottings most distinct dorsolaterally; concealed part of eye with a white tunic, the eyelid heavily pigmented with purple; tympanum almost entirely cream-yellow; border of nostril cream, this bordered by somewhat heavier pigment. Lip bordered by a series of fine elongate white or cream tubercles; limbs colored like back with all tubercles cream-white; ventral surface, sides, and concealed parts of limbs lacking pigment, possibly transparent or colorless in life, now dull, dirty, yellowish white.

Measurements in mm.: Snout to vent, 20; width of head, 7.7; length of head, 7; length of eye, 2.7; length of snout, 2.4; tympanum, .8; arm, 12; hand, 7; leg, 37; tibia, 12; foot and tarsus, 17.

Remarks: Due to the flexed condition of the limb at the elbow and knee joints it is impossible to straighten the limbs completely without injuring the specimen. In consequence the limb measurements are partially an estimation. The specimen however is in a perfect state of preservation. The relationship is thought to be closer to *Cochranella albotunica* and *Cochranella dubia* than to the other forms in southeastern Brasil. Neither of these species however have the cream-white tuberculation, the cream-colored spot covering tympanum, or the outer tarsal fold. Many other differences likewise are in evidence.

The species is named for Dr. P. Vanzolini of the Departamento de Zoologia, São Paulo, Brasil, one of the collectors.

This is one of the most distinctive forms of the genus.

Cochranella albotunica sp. nov.

Type: U. S. National Museum No. 96559, Serra da Bocaina, boundary of Rio de Janeiro and São Paulo, Brasil, A. Lutz, collector; Jan. 2-19, 1930.

Paratypes: U.S.N.M. No. 96557, same locality, data and collector; U.S.N.M. No. 96723, same locality and collector; Mar., 1927.

Diagnosis: Small frog, snout to vent 27 mm. Head broad, tympanum small, at least partly distinct, directed outward and somewhat upward; pigment segregated forming spots and reticulations; very prominent, somewhat protruding anal pads below and partly lateral to vent; suprascapulae very broad more or less distinct; head somewhat spatulate the snout sloping forward from nostrils, which are a little closer to eye than to median point of lip, nostrils large; canthus rostralis not or scarcely indicated; outer fingers one-fifth webbed; choanae large; no vomerine teeth; tongue one-fourth free; venter granular; heel to much beyond snout.

Description of type: Head rather spatulate, its width 8.4 mm. greater than length (7.3 mm.), narrowed in tympanic region; canthus rostralis not or but vaguely indicated, the loreal region not or but slightly concave, sloping very obliquely to lip; area about nostrils swollen, with a distinct depression between them; nostrils moderately large, the snout sloping obliquely to lip; tympanum small, directed almost upward, its greatest diameter about .9 mm.; length of eye, 2.8 mm. greater than its distance from nostril, but shorter than the length of snout (3.2 mm.); eyeball surrounded largely by a white tunic (seen easily on inside of mouth); greatest width of an eyelid (1.8 mm.) distinctly less than interorbital interval (2.15 mm.); (probably a distinct fold above and partly covering upper edge of tympanum); outline of suprascapulae more or less visible, their greatest (longitudinal) width 4.1 mm. Choanae large the greatest diameter of one in distance between the choanae about 2.2 times; no vomerine teeth; tongue a little wider than long, free behind for about one fourth of its length; vocal slits present, somewhat diagonal.

Arm rather long the wrist extending beyond tip of snout; first finger smaller and shorter than second; all fingers with terminal discs distinctly wider than digits, the tips slightly rounded and not or but little angular on sides; none or but a slight vestige of web between first two fingers; between second and third one-fourth, between third and fourth one-third webbed; a thick ridge follows outer side of fingers to disc; a rather large metacarpal tubercle; a rounded, prominent palmar tubercle.

Leg very long the heel extending 3 mm. beyond tip of snout; discs on toes smaller than those on fingers; webbing of foot as follows: between first and second, one-third webbed; between other toes, approximately three-fourths webbed; a small inner meta-

tarsal tubercle, no outer tubercle visible; probably no inner tarsal fold; when legs are folded at right angles to body the heels do not overlap; when pressed on side of body, elbow and knee overlap.

Skin on dorsum generally smooth; venter with small granules; under surface of femur with some granulation; vent high followed by a pair of relatively large postanal pads or tubercles.

Color: (In preservative.) Everywhere transparent flesh. Dorsum with purplish or lavender pigment, the chromatophores segregated to form irregular small spots and reticulations; dorsal surface of limbs, with pigment extending onto outer finger and onto two outer toes; upper arm devoid of pigment.

Measurements in mm.

	96559	96557	96723*
Snout to vent	27	24	22**
Head width	8.4	9.1	...
Head length	7.3	7.4	...
Length of snout	3.2	3.3	...
Length of eye	2.8	2.6	2.5
Arm	17	16	16.3
Hand	8.8	8.9	7.2
Leg	42	41	39
Tibia	14.2	15	13.3
Foot and tarsus	16.3	16.5	15

Remarks: The three specimens are indifferently preserved, and one, No. 96723, has the front part of the face missing. All show the same general distribution of the pigment, and all show the postanal pads well developed. The character of the granular belly, spatulate head, position of the nostril, and segregation of the chromatophores in groups forming "spots" and reticulations are characteristic of this form.

Cochranella parvula Boulenger

Hylella parvula Boulenger Proc. Zool. Soc. London, 1894, p. 646, pl. 40, fig. 3
(Lages and Theresopolis, Santa Catharina, Brasil.)

Diagnosis: A diminutive species (17 mm. snout-vent length); tympanum distinct belly granular; heel to a point a little beyond snout; upper eyelid very narrow, the interorbital space broad and convex; head as long as broad.

Description of type: (From Boulenger).

"Tongue circular, entire. Head as long as broad; snout short, rounded; no canthus rostralis; eye large and very prominent; upper eyelid very narrow; interorbital space broad and convex; tympanum distinct, hardly one third the diameter of the eye. Fingers dis-

* Tip of snout missing.

** Estimated.

tinctly webbed at the base, first slightly shorter than second; toes two-thirds webbed; disks moderate. Tibio-tarsal articulation reaching a little beyond the tip of the snout. Skin smooth above; belly and lower surface of thighs granulate. Grayish or pale brown above, speckled with white; lower parts white.

"From snout to vent 17 millimeters. Two specimens. One from Lages, Santa Catharina, collected by Hr. Michaelis; The other from Theresopolis, presented by Dr. Göldi.

"This species appears to be most nearly allied to *H. carnea*, Cope, but the tympanum is perfectly distinct and the coloration is entirely different."

Several pertinent characters are omitted from the description. However it does not seem to be synonymous with any of the forms described here as new.

DESCRIPTION OF TADPOLES

Associated with one lot of U.S.N.M. specimens (Nos. 96652-96662) is a series of four tadpoles bearing the number 96663 from the same locality. The tadpoles differ in size and there is no assurance that they belong to this species, or that all the tadpoles are conspecific. There is a very strong probability that they are *Cochranella* tadpoles. To differentiate the four tadpoles they are referred to as: A (37 mm.), B (30 mm.), C (24 mm.), and D (23 mm.).

The specimens are indifferently preserved, and that all the external tooth rows are present cannot be affirmed.

Specimen A: The largest specimen has a somewhat elongate oval body; the eyes dorsal and rather close together, their greatest diameter 1.3 mm.; their distance from the tip of the snout .35 mm.; distance between nostrils 2.1 mm.; the distance from eye to nostril (1.25 mm.) distinctly less than their distance to end of head (2.3 mm.). Spiracle sinistral its distance from anterior head level, 9.4 mm.; length of body from head to end of anal tube 13 mm.; from vent to tip of tail, 24; mouth located very close to front level of head on ventral surface (median point on upper horny beak .5 mm. from tip of snout); a large free frill surrounds lateral and posterior rim of mouth, 1.1 mm. wide mesially, its edge denticulate; just posterior to mouth the frill has certain fleshy ridges which may have borne horny teeth (the posteriormost has some minute fleshy denticulations); horny upper beak broadly curving, bearing on its edge a series of fine denticulations (approximately 38); lower beak much

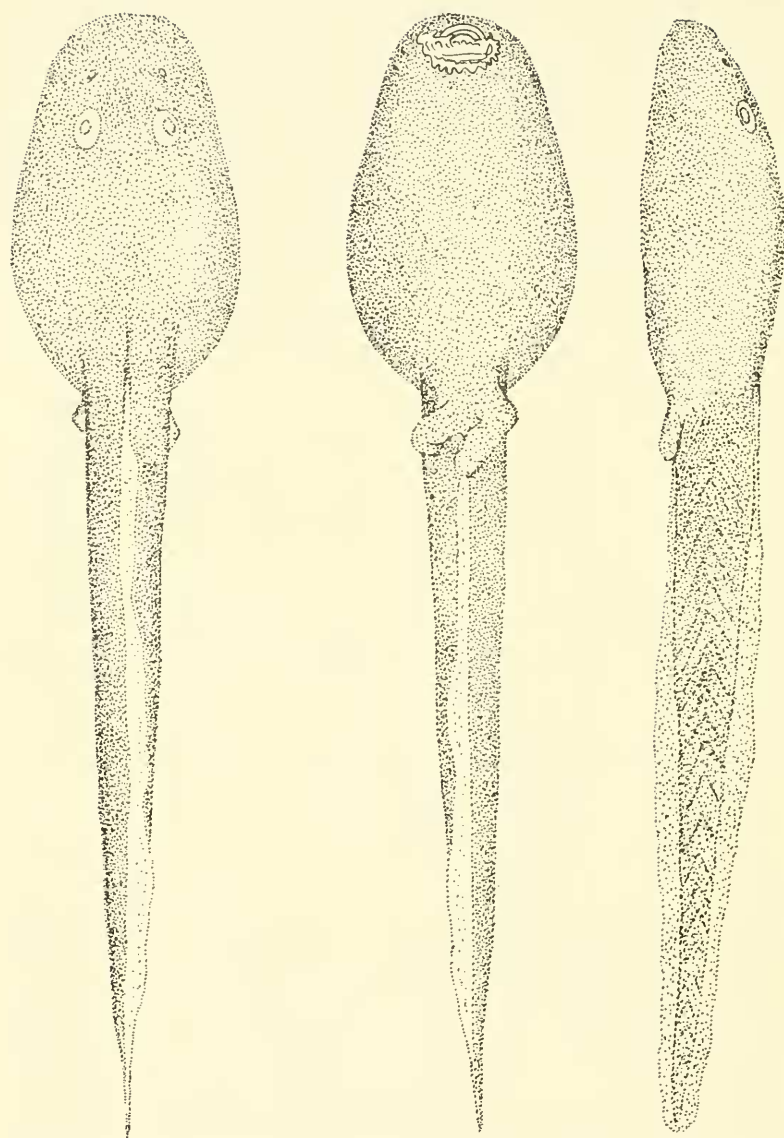


FIG. 4. Tadpole presumed to be that of *Cochranella*. Specimen A enlarged.

narrower with approximately the same number of denticulations but of smaller size, those near the outer ends a little larger. Hind limbs approximately 3 mm. long, the feet showing no development of the toes. Dorsal caudal fin begins at a point about 2 mm. in front of level of developing legs; anal opening definitely mesial; greatest width of the caudal expansion 4.2 mm., the musculature, continued to extreme tip, strongly attenuated.

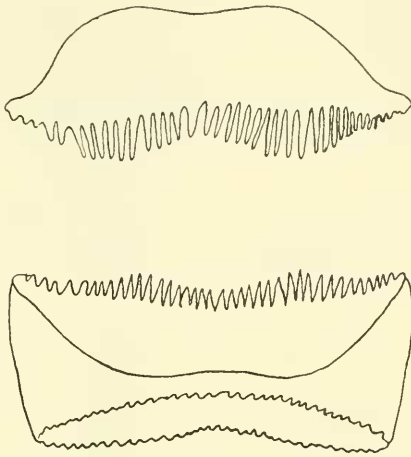


FIG. 5. Teeth of tadpole presumed to belong to *Cochranella*. Specimen A enlarged.

Specimen B: This specimen (30 mm. total length) is younger, presumably, since there is no external trace of developing hind legs; the body is somewhat elongate-spatulate, and the eyes are very small comparatively (about .35 mm. in greatest diameter), while the distance between them is approximately 1.1 mm.; eye to tip of snout, 3.05 mm.; eye to nostril, 1.55 mm.; spiracle sinistral, its distance from anterior head level, 7 mm.; snout to end of anal tube, 11 mm.; snout to base of tail, 10 mm.; vent to tip of tail, 19 mm.; greatest width of head, 6 mm.; body width at spiracle, 4.3 mm.; greatest elevation of fin, 2 mm.; greatest height of tail, 4 mm.; width between nostril, 1.9 mm.

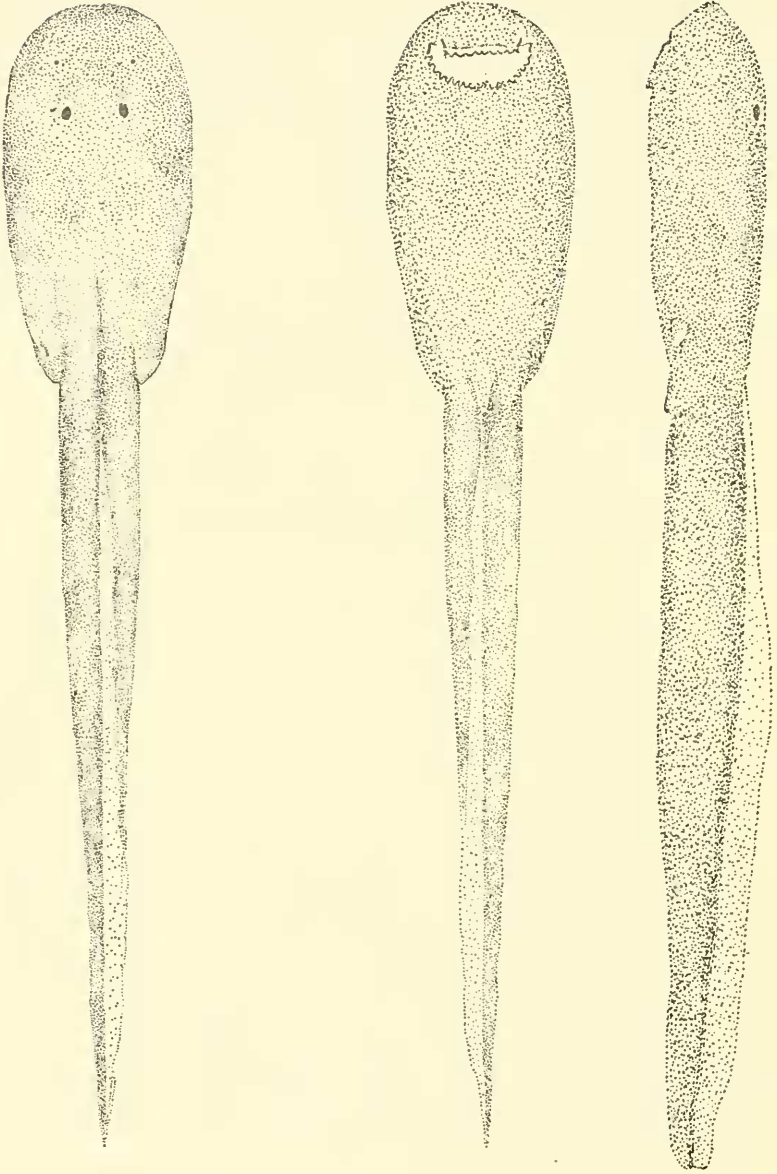


FIG. 6. Tadpole, presumed to be that of a species of *Cochranella*.
Specimen B enlarged.

Mouth is surrounded on lateral and posterior parts with a free frill. Mouth ventral, 1 mm., back from the end of the head. The front upper part of the beak is slightly curved, the denticulations strongly marked, small at outer edges becoming gradually larger, then diminishing in size in the mesial region. The eight median teeth smaller, all of approximately the same size. There is a total

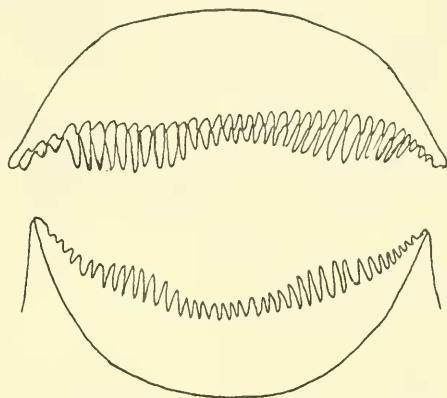


FIG. 7. Teeth of tadpole presumed to be a species of *Cochranella*. Enlarged.

of 32 denticulations. The beak on lower jaw is deep within the mouth and likewise denticulate, but more strongly curved, the row consisting of about 30 denticulations suddenly increasing in size near the outer ends. Within the mouth and invisible when mouth is closed are two rows of very fine denticulations the more posterior nearly on a level but following the curve of the jaw, the more anterior is slightly arched but likewise following the curve of the mandible back of the beak.

The frill is denticulate on its edge, mesially, a millimeter wide but narrowing a little laterally; a row of small papillae border edge of lip and there are no fleshy ridges on the surface of the frill. At no point does the width of the tail and its fin exceed 4 mm. elevation.* No pigmentation whatever is visible.

Specimen C and D have lost much of the buccal frill but while one seems to agree with B in the character of the denticulation, the

* This specimen was accidentally destroyed before the characters of the ventral caudal fin were ascertained.

other suggests still a third form, as regards the denticulations on the beak. Here the teeth are fewer, large, and not reduced in the middle part of the series.



Map of southern Brazil showing type localities